

## PENT COOPERATION TREA

PCT

From the INTERNATIONAL BUREAU

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C.20231  
 ÉTATS-UNIS D'AMÉRIQUE

Date of mailing (day/month/year) 09 November 1999 (09.11.99)	in its capacity as elected Office
International application No. PCT/SE99/00254	Applicant's or agent's file reference W 3879-001
International filing date (day/month/year) 24 February 1999 (24.02.99)	Priority date (day/month/year) 05 March 1998 (05.03.98)
Applicant ANDERSSON, Stig	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:  
15 September 1999 (15.09.99)

in a notice effecting later election filed with the International Bureau on:  
\_\_\_\_\_

2. The election  was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer  F. Baechler
Faxsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

# RECORD COPY

## PCT

### REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No. PCT/SE99/00254

24-02-1999

International Filing Date

The Swedish Patent Office  
PCT International Application

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference W 3879-001  
(if desired) (12 characters maximum)**Box No. I TITLE OF INVENTION  
REFLECTING MATERIAL****Box No. II APPLICANT**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

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Sweden

 This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:  
SwedenState (that is, country) of residence:  
Sweden

This person is applicant  all designated States  all designated States except the United States of America only  the United States of America only  the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

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Lerbergsvägen 72  
SE-263 32 HÖGANÄS  
Sweden

This person is:

 applicant only applicant and inventor inventor only (If this check-box is marked, do not fill in below)State (that is, country) of nationality:  
SwedenState (that is, country) of residence:  
Sweden

This person is applicant  all designated States  all designated States except the United States of America only  the United States of America only  the States indicated in the Supplemental Box

 Further applicants and/or (further) inventors are indicated on a continuation sheet.**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

agent

 common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

STRÖM & GULLIKSSON AB  
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## Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

## Regional Patent

- AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
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National Patent (if other kind of protection or treatment desired, specify on dotted line):

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Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

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- 

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 05 March 98 05/03/98	9800689-3	Sweden		
item (2)				
item (3)				

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

**Box No. VII INTERNATIONAL SEARCHING AUTHORITY**

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / SE 18/03/98 SE 98/00199 Sweden

**Box No. VIII CHECK LIST; LANGUAGE OF FILING**

This international application contains the following number of sheets:	This international application is accompanied by the item(s) marked below:	
request : 3 ✓	<input checked="" type="checkbox"/> fee calculation sheet	
description (excluding sequence listing part) : 8 ✓	<input type="checkbox"/> separate signed power of attorney	
claims : 2 ✓	<input type="checkbox"/> copy of general power of attorney; reference number, if any:	
abstract : 1 ✓	<input type="checkbox"/> statement explaining lack of signature	
drawings : 1 ✓	<input type="checkbox"/> priority document(s) identified in Box No. VI as item(s):	
sequence listing part of description :	<input type="checkbox"/> translation of international application into (language):	
	<input type="checkbox"/> separate indications concerning deposited microorganism or other biological material	
	<input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form	
Total number of sheets : 15 ✓	<input type="checkbox"/> other (specify):	

Figure of the drawings which should accompany the abstract: 4 Language of filing of the international application: Swedish

**Box No. IX SIGNATURE OF APPLICANT OR AGENT**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Malmö, February 23, 1999

Stellan Petri

For receiving Office use only		
1. Date of actual receipt of the purported international application:	2 4 -02- 1999	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 1(2):		
5. International Searching Authority (if two or more are competent): ISA / SE	<input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	2. Drawings:

received:

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Date of receipt of the record copy by the International Bureau:	31 MARCH 1999	(31.03.99)

24-02-1999

SÖKANDE: Decoresponz i Helsingborg AB

UPPFINNINGENS BENÄMNING: REFLEKTERANDE MATERIAL

5

Föreliggande uppföring avser ett material för varmformning samt användning av detta material vid framställning av en reflekterande produkt medelst varmformning.

Under utövning av olika aktiviteter i mer eller mindre dålig belysning är det viktigt för den utövande personen att vara väl synlig. För närvarande skyddar man sig numera endast nödorftigt med olika typer av reflexer för att vara synlig vid dåliga ljusbetingelser. Detta gäller inte enbart för många typer av fritidsaktiviteter, såsom cykling och ridning, utan även vid mer yrkesutövande aktiviteter, som för exempelvis brandmän eller byggnadsarbetare, vilka behöver skydda sig med adekvata reflexer under sin yrkesutövning. I detta sammanhang avses med en "reflex" en reflexion av ljus som återkastas i riktningar, som ligger nära belysningsriktningen.

Det är speciellt viktigt i den hektiska trafikmiljö som numera förekommer att skydda huvudet; detta gäller för såväl barn som vuxna. Konventionella hjälmar ger emellertid ingen hjälp att enkelt upptäckas av t ex motorförare vid dåliga ljusförhållanden, och användaren kan även om han använder hjälm riskera att skadas i en trafikolycka vid sådana tillfällen. För att varna en motorförare under dessa förhållanden finns det nu olika typer av reflekterande varningsmärken kommersiellt tillgängliga, som är synliga på natten då de belyses.

Ordinära, plana reflexer har emellertid en begränsat skyddande effekt i och med att de enbart avger ljus då träffas av ljus från ett enda håll. Visserligen förekommer det olika slags självhäftande, reflekterande tejp, som kan fästas på t ex klädesplagg eller hjälmar. Emellertid kan ett självhäftande material, såsom en dekal, p.g.a. veckbildning ej appliceras på en välvda yta. Ej heller kan det

av samma skäl appliceras på ett arkformigt material som därefter medelst varmformning anbringas på en välvda yta, eftersom materialet då kommer att spricka eller krackelera. På grund av ovan nämnda problem förlorar reflekterande 5 material enligt känd teknik, som appliceras på oregelbundna eller välvda ytor, därför snabbt sina reflekterande egenskaper.

Det avses sålunda att genom uppfinningen åstadkomma ett reflekterande material som kan användas både som ett 10 reflekterande plant ark i sig och som ett material vid varmformning, företrädesvis vid vakuumformningen, till en välvda eller oregelbunden yta, varvid materialet bibehåller sin reflekterande förmåga utan sprickbildning eller krackelering.

I detta syfte har materialet enligt uppfinningen 15 erhållit de kännetecken, som framgår av patentkravet 1, och dess användning har erhållit de kännetecken, som framgår av patentkravet 14.

För närmare förklaring av uppfinningen hänvisas till 20 bifogade ritning, på vilken

FIG 1 schematiskt visar ett tvärsnitt genom ett arkformigt reflekterande material enligt uppfinningen,

FIG 2 schematiskt visar ett tvärsnitt av en vidare-utveckling av den i FIG 1 visade utföringsformen av 25 materialet enligt uppfinningen,

FIG 3 schematiskt visar ett tvärsnitt genom en alternativ utföringsform av materialet enligt uppfinningen, och

FIG 4 schematiskt visar ett tvärsnitt genom ett 30 material enligt en föredragen utföringsform av uppfinningen.

I FIG 1 visas materialet enligt uppfinningen i sin enklaste form och består av ett plant ark 1, som är belagt med ett reflekterande skikt 2. Arket 1 kan vara av alla typer av plast. Emellertid föredrages att arket utgöres av 35 ett transparent, termoplastiskt polymermaterial, före-

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trädesvis glasklar polyvinylklorid (PVC) eller polyester, varvid polyestern torde användes eftersom det att den är mer miljövänlig.

Det reflekterande skiktet 2 består av en suspension 5 av pärlor, exempelvis av glas eller plast, i en vidhäftande substans, företrädesvis en lack. Med lack avses i detta sammanhang en opigmenterad vätska med ett organiskt filmbildande ämne, som kan vara en naturharts, en syntetharts eller en olja, och företrädesvis användes en s k screen-10 tryckslack.

Det är en viktig aspekt av uppförningen, att pärlor av lämplig storlek blandas med en vidhäftande substans. Företrädesvis har pärlorna en diameter mellan 0,01 och 15 0,05 mm. Den vidhäftande substansen måste kunna fästa på plasten samtidigt som den skall kunna binda till pärlorna och utgör således en etsande, glasklar limbeläggning. Med etsning avses i detta sammanhang en ökning av den använda plastens ytråhet genom upplösning av densamma. Efter appli-20 ceringen av det reflekterande skikt 2 härdas den vidhäftande substansen i form av en lack, företrädesvis med värme, men den kan även härdas på andra sätt, t ex genom bestrålning.

För att ett reflekterande laminerat material enligt uppförningen skall kunna erhållas, blandas vidhäftande 25 substans och pärlor av exempelvis glas eller plast till en suspension, vilken måste ha en passande konsistens för att pärlorna av mikroskopisk storlek skall kunna överföres till det plana arket 1 medelst känd teknik i form av duktryck. Detta är en metod som normalt användes för att anbringa ett 30 mönster på ett plastark, som skall utsättas för termoformning. Pärlornas storlek är således även avpassade att kunna passera genom de öppna hålen i en dukstencil, som normalt användes för att pressa ett mörnstermedium mot arket. Då de använda pärlorna är av glas måste dessa vara polerade 35 pärlor av hög kvalitet. Lämpligen användas samma typ av

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glasfärlor som i förekommande reflekterande tejp. Företrädesvis ligger glaspärlornas storlek inom området 0,01-0,05 mm.

Genom detta förvarande förankras suspensionen på det 5 plana materialet, varvid en reflexyta åstadkommes. Ju fler pärlor som kan inblandas i suspensionen desto bättre reflexverkan erhålls. Härvid kunde den i den vidhäftande substansen i form av en lack suspenderade mängden glaspärlor överraskande utgöra så mycket som 85 %. Detta 10 medför, att det åtgår ca 1 kg glaspärlor för att täcka 4-5 m<sup>2</sup> av arket, vilket efter termoformning exempelvis kan utnyttjas till skal för ca 50 hjälmar av normalstorlek.

Materialet enligt uppföringen enligt denna 15 utföringsform kan även utnyttjas att åstadkomma en reflex åt två håll genom att det reflekterande skiktet appliceras på bågge sidorna av en lämplig yta. Lämpligen är denna yta ett ark av plastmaterial, som kan termoformas. Företrädesvis används alla slags förekommande material av polyvinylklorid (PVC), dvs samtliga termoplastiska material som 20 utgöres av polymerer av vinylklorid. Även utan termoformning kan det plana, reflekterande materialet användas i form av t ex ett vägmärke eller annat varningsmärke, som anger fara eller andra förhållanden som bör observeras av allmänheten.

När det reflekterande skiktet 2 på arket 1 har 25 applicerats, kan andra motiv tryckas på materialet enligt uppföringen. Därefter varmformas dessa, t ex genom vakuumformning, till en form, som motsvarar de välvda ytor, som de bildade skalen är avsedda att passa till. Det termoplastiska materialet enligt uppföringen i form av en plan 30 eller flexibel skiva eller folie av en för vakuumformning tillräcklig tjocklek uppvärmes härvid till varmformningstemperaturen för detsamma och formas till den generella konturen hos ett formverktyg med hjälp av en 35 tryckdifferens. Vakuumformning utföres således med känd

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teknik vid 130 °C, varvid materialet drages och spännes ut till skal, som har formen av exempelvis en hjälm.

Efter avsvalning av de bildade tunna skalen sågas dessa till enskilda enheter, och hål stansas eventuellt i s dem. Om skalen skall användas till en färdig produkt i form av en hjälm, limmas slutligen skalen på en innerhjälm, som besitter den för huvudet skyddande effekten.

Hjälmen kan därefter, om så önskas, byggas in med ytterligare ett lager av plast. Detta kan vara nödvändigt, 10 eftersom den faktiska reflexen kan dämpas, t ex vid fuktig väderlek. Därför lägges ytterligare en beläggning (coating) på den färdiga produkten, dvs ett lager som medför att det reflekterande skiktet skyddas och förstärkes än mer. Detta kan åstadkommas genom att, så som visas i FIG 2, ett ytterligare skikt 3 av företrädesvis PVC medelst exempelvis hög-frekvenssvetsning anbringas på det reflekterande skiktet 2, som i sin tur är anordnat på det plana arket 1.

En mer kostnadseffektiv utföringsform av uppfinningen enligt FIG 1 visas i FIG 3, varvid liksom ovan utnyttjas 20 ett plant ark 1 av företrädesvis ett vakuumformbart plastmaterial. I denna utföringsform är på arket 1 anordnat ett skikt 4a av vidhäftande substans, på vilket ett tunt skikt 5 av pärlor är applicerat. Över detta skikt av pärlor är ånyo ett skikt 4b av vidhäftande substans anordnat.

25 Skikten 4a och 4b utgörs företrädesvis av samma transparenta, glasklara vidhäftande substans i form av en lack, varvid lacken i skiktet 4a är etsande så som i föregående utföringsformer.

Med hänvisning till FIG 3 åstadkommes det reflek- 30 terande laminerade materialet genom att det etsande skiktet 4a av vidhäftande substans appliceras på arket 1. Innan detta skikt har torkat fördelas pärlor på detsamma. Detta kan exempelvis åstadkommas maskinellt med en utrustning som vanligtvis utnyttjas för att belägga med olika slags 35 pulver. Härvid skakas t ex glaspärlor så att de faller ned

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på det fortfarande klibbiga skiktet 4a, varigenom ett monolger av glaspärlor kommer i kontakt med detsamma med ej vidhäftande pårlor ovanpå. Arket med tillhörande skikt 4a och 5 får därefter lov att passera en ugn för härdning av  
5 den vidhäftande substansen i skiktet 4a. När väl detta härdats, kan ej vidhäftande glaspärlor sugas av och återanvändas. Ett nytt skikt 4b med vidhäftande substans appliceras därefter på glaspärleskiktet 5, varefter arket med tillhörande skikt ånyo får lov att passera ugnen för härd-  
10 ning av skiktet 4b.

Även materialet enligt denna utföringsform av uppfinningen kan vakuumformas till ett reflekterande skal att appliceras på en välvda yta utan att någon krackeleringen sker under formningsförfarandet. Den reflekterande ytan är  
15 för många tillämpningar tillräckligt effektiv för att en effektiv reflexverkan skall kunna erhållas.

I FIG 4 visas en utföringsform, som är speciellt föredragen då materialet enligt uppfinningen skall utnyttjas för reflekterande hjälmar. Genom att anordna  
20 produkten i form av ett skal från materialet enligt uppfinningen t ex på insidan av en cykelhjälm, i vilken urtagningar gjorts för det reflekterande materialet, kan den reflekterande produkten användas på ett mer från omgivningen skyddat ställe. Detta åstadkommes i denna  
25 utföringsform genom att skikten hos materialet enligt uppfinningen är anordnade på den sida av arket 1 som ej i den färdiga hjälmen kommer att vara riktad mot belysningskällan, dvs arket 1 fungerar som skyddande skikt för övriga skikt.

Med hänvisning till FIG 4 är ett färgskikt 6 anordnat mellan arket 1 och skiktet 4a av vidhäftande substans.  
Färgskiktet 6 utgörs av en transparent (genomsynlig) färg som är känd inom tekniken och som kan uteslutas i beroende av slutprodukten design och utseende. Det reflekterande  
35 skiktet 5 är så som i föregående utföringsform anordnat i

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form av ett enda lager av pärlor, exempelvis av glas eller plast, mellan två skikt, 4a och 4b, av vidhäftande substans. Den använda vidhäftande substansen borde härvid kunna etsa såväl färg som plast.

5 För att förstärka reflexen ytterligare är ett skikt 7  
av ett material med hög glans, t ex av silver eller aluminium, anordnat på skiktet 4b av vidhäftande substans.  
Företrädesvis användes aluminiumpartiklar. Då det reflek-  
terande skiktet 5 belyses, kommer således det ljus som inte  
10 omedelbart återkastas av detta skikt att reflekteras med en  
total reflektans av skiktet 7 och vidarebefordras mot  
betraktaren efter refraktion av pärlna i skiktet 5.

Skiktet 7 påföres, företrädesvis i form av en  
kommersiell pasta aluminiumpartiklar, laminatet enligt  
15 uppfinningen medelst ovan nämnda kända teknik i form av  
duktryck.

Det reflekterande laminerat materialet enligt upp-  
finningen kan därefter upphettas till en för vakuiformning  
lämplig temperatur, t ex 130 °C, varefter vakuiformning  
20 utföres så som beskrivits ovan. Det arkformiga  
reflekterande material enligt uppfinningen måste härvid ha  
en tillräcklig tjocklek med tanke på den efter vakuum-  
formning tilltänkta produkten. Exempelvis kan materialet  
vakuumformas till ett hjälmskal som blir högreflekterande  
25 från utsidan med det reflekterande skiktet på insidan av  
hjälmen, vilket därmed kommer att skyddas från all typ av  
skadegörelse. Sålunda kan en hjälm av slagtälig plast  
erhållas med såväl reflekterande mönster som sedvanliga  
mönster, vilket kan medföra en ökad trafiksäkerhet,  
30 speciellt för barn.

Det bör påpekas, att ett färgskikt, om så önskas, kan  
anordnas på motsvarande sätt i övriga utföringsformer av  
uppfinningen. Färgskiktets placering i lamellatet är härvid  
inte avgörande. En färg kan även iblandas suspensionen av  
35 pärlor och vidhäftande substans, varvid en reflex av färgen

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erhålls. Färgerna bör härvid även vara transparenta.  
Vidare är det av vikt att samtliga transparenta bestårndelar i materialet enligt uppfinningen bibehåller denna egenskap efter varmformning, såsom vakuumformning.

- 5 Varnande artiklar, som tillverkats medelst föreliggande uppfinning, erbjuder en reflekterande konstruktion som är varaktig, relativt billig och väl synlig under dåliga, naturliga ljusförhållanden, speciellt på natten då de reflekterande elementen lysas upp av en yttre, aktiv  
10 ljuskälla, såsom ljuset från en bilstrålkastare. Genom att materialet enligt uppfinningen kan vakuumformas kan uppfinning utnyttjas för ökad säkerhet, speciellt i trafiken. Produkter med en oregelbunden eller välvda yta kan framställas med en ändamålsenlig reflexverkan då föreliggande  
15 uppfinning utnyttjas. Sålunda kan allehanda ljusreflektorerande produkter åstadkommas, såsom cykelhjälmar bygg-hjälmar, lekhjälmar för barn etc. Uppfinningen kan således utnyttjas som ett reflekterande material med förmåga att reflektera ljus och därmed bli synlig från alla håll, dvs  
20 ett retroreflekterande material som alstrar en reflex i alla riktningar och som således kan användas som en person-reflex. Även andra produkter för ökad trafiksäkerhet där en heltäckande och reflekterande yta önskas, såsom navkapslar med dekor och reflekterande mönster, kan erhållas med  
25 användande av uppfinningen.

## PATENTKRAV

1. Material för varmformning, kännetecknat  
natt av att materialet utgöres av ett skikt (2, 5) av  
5 reflekterande pärlor i en vidhäftande transparent substans  
vilket på sin ena sida är anordnat i anslutning till ett  
första plastskikt (1).

10 2. Material enligt krav 1, kännetecknat  
av att i anslutning till den andra sidan av skiktet (2) av  
reflekterande pärlor i en vidhäftande transparent substans  
är anordnat ett andra plastskikt (3).

15 3. Material enligt krav 1, kännetecknat  
av att den vidhäftande substansen utgöres av ett första och  
ett andra skikt (4a, 4b) omgivande ett skikt (5) av  
reflekterande pärlor, varvid det första skiktet (4a) är  
anordnat i anslutning till det första plastskiktet (1).

4. Material enligt krav 3, kännetecknat  
av att pärlorna i skiktet (5) är anordnade i ett enda  
lager.

20 5. Material enligt något av föregående krav,  
kännetecknat av att pärlorna är av glas eller  
plast.

25 6. Material enligt något av föregående krav,  
kännetecknat av att pärlorna har en diameter  
mellan 0,01 och 0,05 mm.

7. Material enligt något av kraven 1-3, kännetecknat  
av att plastskiktet (1, 3) är transparent.

30 8. Material enligt krav 6, kännetecknat  
av att platskiktet (1, 3) utgörs av polyvinylklorid eller  
polyester.

35 9. Material enligt krav 8, kännetecknat  
av att då det andra platskiktet (3) utgörs av poly-  
vinylklorid detta är fäst vid den andra sidan av skiktet  
(2) av reflekterande pärlor i en vidhäftande transparent  
substans medelst högfrekvenssvetsning.

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10. Material enligt något av kraven 1-3, kännetecknats att den vidhäftande substansen är en etsande lack.

11. Material enligt krav 10, kännetecknats att lacken är en skreentryckslack.

12. Material enligt något av kraven 1-3, kännetecknats att ett skikt (6) av en transparent färg är anordnat i anslutning till det första plastskiktet (1).

13. Material enligt krav 3, kännetecknats att ett skikt (7) av partiklar med total reflektans är anordnat i anslutning till sagda andra skikt (4b) av vidhäftande substans.

14. Material enligt krav 13, kännetecknats att partiklarna med total reflektans är aluminiumpartiklar.

15. Material enligt något av kraven 1-14, kännetecknats att materialet är en plan skiva eller folie.

16. Användning av ett material enligt något av kraven 1-15 vid framställning av en reflekterande produkt medelst varmformning.

17. Användning enligt krav 16, kännetecknats att varmformningen är vakuumformning.

18. Användning enligt krav 17, kännetecknats att vakuumformningen utföres till en välvda yta.

19. Användning enligt krav 18, kännetecknats att den välvda ytan har formen av en hjälm.

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## SAMMANDRAG

Ett material för varmformning utgöres av ett plast-skikt samt ett skikt av reflekterande pärlor i anslutning  
5 till en vidhäftande transparent substans. Materialet är lämpligt att användas vid framställning av en reflekterande produkt medelst varmformning.

10

Publiceras med FIG 4.

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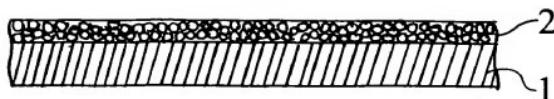


Fig 1

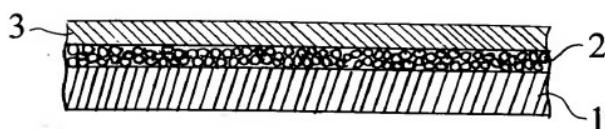


Fig 2

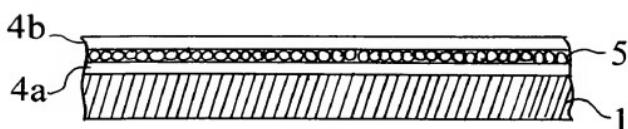


Fig 3

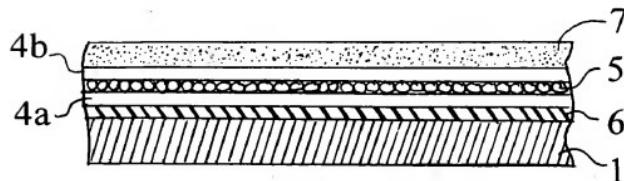


Fig 4

CLAIMS

1. Material for thermoforming, characterized in that the material comprises a layer (2,5) of reflecting pearls in an adhering transparent substance which on one of its sides is arranged adjacent to a first plastic layer (1).
2. Material as in claim 1, characterized in that a second plastic layer (3) is arranged adjacent to the other side of the layer (2) of reflecting pearls in an adhering transparent substance.
3. Material as in claim 1, characterized in that the adhering substance comprises a first and a second layer (4a, 4b) surrounding a layer (5) of reflecting pearls, the first layer (4a) being arranged adjacent to the first plastic layer (1).
4. Material as in claim 3, characterized in that the pearls in the layer (5) are arranged as a monolayer.
5. Material as in any of claims 1-4, characterized in that the pearls are made of glass or plastic.
6. Material as in any of claims 1-5, characterized in that the pearls have a diameter between 0.01 and 0.05 mm.
7. Material as in any of claims 1-3, characterized in that the plastic layer (1,3) is transparent.
8. Material as in any of claims 1-3, characterized in that the plastic layer (1,3) comprises polyvinyl chloride or polyester.
9. Material as in claim 8, characterized in that when the second plastic layer (3) comprises polyvinyl chloride this layer is attached to the other side of the layer (2) of reflecting pearls in an

adhering transparent substance by means of high-frequency welding.

10. Material as in any of claims 1-3, characterized in that the adhering substance is an etching lacquer.

11. Material as in claim 10, characterized in that the lacquer is a screen printing lacquer.

12. Material as in any of claims 1-3, characterized in that a layer (6) of a transparent dye is arranged adjacent to the first plastic layer (1).

13. Material as in claim 3, characterized in that a layer (7) of particles with total reflectance is arranged adjacent to said other layer (4b) of adhering substance.

14. Material as in claim 13, characterized in that the particles with total reflectance are aluminium particles.

15. Material as in any of claims 1-14, characterized in that the material is a plane sheet or a foil.

16. Use of a material as claimed in any of claims 1-15 for the manufacturing of a reflecting product by means of thermoforming.

17. Use as in claim 16, characterized in that the thermoforming is vacuum forming.

18. Use as in claim 17, characterized in that vacuum forming is accomplished to a curved surface.

19. Use as in claim 18, characterized in that the curved surface has the form of a helmet.

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>W 3879-001</b>	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. <b>PCT/SE99/00254</b>	International filing date (day/month/year) <b>24/02/1999</b>	Priority date (day/month/year) <b>05/03/1998</b>
International Patent Classification (IPC) or national classification and IPC <b>G02B5/128</b>		
<b>Applicant</b> <b>DECORESPONZI HELSINGBORG AB</b>		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I    <input checked="" type="checkbox"/> Basis of the report</li> <li>II    <input type="checkbox"/> Priority</li> <li>III    <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV    <input type="checkbox"/> Lack of unity of invention</li> <li>V    <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI    <input type="checkbox"/> Certain documents cited</li> <li>VII    <input checked="" type="checkbox"/> Certain defects in the international application</li> <li>VIII    <input checked="" type="checkbox"/> Certain observations on the international application</li> </ul>		

Date of submission of the demand <b>15/09/1999</b>	Date of completion of this report <b>07.07.2000</b>
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer   La Penna, P Telephone No. +49 89 2399 2291

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/SE99/00254

## **I. Basis of the report**

1. This report has been drawn on the basis of (substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments):

**Description, pages:**

1-9 as published

Claims No.:

1-13 as received on 13/06/2000 with letter of 08/06/2000

### **Drawings, sheets:**

1/1 as published

2. The amendments have resulted in the cancellation of:

- the description, pages:
  - the claims, Nos.:
  - the drawings, sheets

3.  This report has been established as if (some or) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 702(c)).

- #### 4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/SE99/00254

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims 1-13
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-13
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-13
	No:	Claims

**2. Citations and explanations**

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. The subject-matter of independent claim 1, if it is understood in accordance with point VIII-2 below, differs from the disclosure of the closest prior art document D10 (US 4 025 159 A) in that the "reflecting layer" (2,5) (see figures) and the "first transparent layer" (1) are continuously adherent one to the other and shaped by means of thermoforming so that after cooling they have a curved or irregular shape like a helmet, whereas in D10 thermoforming is used to make the layers (11,15) and (12) adhere by means of pressing these layers between heated platens, one of which being the embossing plate (19) (see D10, col.3, lines 52-54), so that the layers result to be adherent only in some portions, like the grid (13) of fig.1.  
The above described production process of the sheet of D10 is not suited to shape the layers of D10 in a curved shape like a helmet. In fact, D10 does not explicitly mention the intent to give to the sheet a curved shape, the aim being rather the production of plane sheetings (see figures) having sealed cells in order to prevent the penetration of moisture onto the retroreflecting layer: these cells would break if the sheeting were bent or curved.
2. None of the further available prior art documents suggest to modify the apparatus of D1 in a way which would lead to the subject-matter of claim 1. In particular, none of these documents mention neither explicitly the use of thermoforming for shaping a retroreflective sheeting, nor the necessity of preforming a retroreflecting sheeting in a curved or irregular shape: in all the cases in which the fitting of a retroreflecting sheeting to a curved or irregular surface is provided, this is achieved by means of a retroreflective adhesive tape (see for example D1, D3, D4, D7), rather than with a sheeting which has been previously heated, preformed and cooled.
3. As a consequence the subject-matter of independent claim 1 meets the criteria of Art.33(3) PCT in respect of inventive step.
4. The other claims 2-13 are dependent claims, which define more detailed

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/SE99/00254

embodiments.

**Re Item VII**

**Certain defects in the international application**

1. Since document D10 is not identified in the description and the relevant background art disclosed therein is not discussed, the criteria of Rule 5 (1) (a) PCT are not met.
2. Since the independent claims are not drafted in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art (document D10) being placed in a preamble and with the remaining features being included in a characteristic part, Rule 6.3 (b) PCT, Rule 6.3 (b) (i) PCT and Rule 6.3 (b) (ii) PCT are not met.

**Re Item VIII**

**Certain observations on the international application**

1. It appears that the formulation "use of a material" in all the claims could be better expressed by a formulation defining a "method of manufacturing" a reflecting layer.
2. The expression "adjacent to" in independent claim 1, line 6, does not make clear whether the "reflecting layer" is in continuous contact and adherent on its whole surface to the "first transparent layer" of line 7, or whether it is just proximate, without being adherent to the "reflecting layer" on its whole surface.  
However, it appears from all the embodiments (see figs. 1-4) that these two layers are placed in close and continuous contact one with the other. This definition is essential for the performing of the invention.

## CLAIMS

1. Use of a material comprising a reflecting layer (2,5) of pearls of transparent glass or plastic at least  
5 partially embedded in an adhering transparent substance,  
said layer being arranged at one side thereof adjacent to  
a first transparent plastic layer (1) comprising polyvinyl  
chloride or polyester, for manufacturing, by means of  
thermoforming, a retro-reflecting shell which, after  
10 cooling, has a curved or irregular surface shaped as a  
helmet with the capability of reflecting light in all  
directions.

2. Use as in claim 1, characterized  
in that the thermoforming is vacuum forming.

15 3. Use as in claim 1 or 2, characterized  
in that the material is a plane sheet or a foil.

4. Use as in claim 1 or 2, characterized  
in that a second transparent plastic layer (3)  
comprising polyvinyl chloride or polyester is arranged on  
20 the other side of the layer of pearls, opposite to said  
first transparent plastic layer (1).

25 5. Use as in claim 1 or 2, characterized  
in that the adhering substance comprises a first  
and a second layer (4a, 4b) surrounding the layer (5) of  
pearls, the first layer (4a) being arranged adjacent to  
said first transparent plastic layer (1).

6. Use as in claim 5, characterized  
in that the pearls in the layer (5) form a monolayer.

30 7. Use as in any of claims 1-6, characterized  
in that the pearls have a diameter between  
0.01 and 0.05 mm.

35 8. Use as in claim 4, characterized  
in that when the second plastic layer (3) comprises  
polyvinyl chloride it is high-frequency welded to the  
reflecting layer (2).

9. Use as in any of claims 1-8, characterized in that the adhering transparent substance is a lacquer.

10. Use as in claim 9, characterized in that the lacquer is a screen printing lacquer.

11. Use as in any of claims 1-5, characterized in that a layer (6) of a transparent dye is arranged adjacent to said first transparent plastic layer (1).

12. Use as in claim 5, characterized in that a high gloss material layer (7) is arranged adjacent to said second layer (4b) of the adhering substance opposite to the reflecting layer (5) of pearls.

13. Use as in claim 12, characterized in that the high gloss material layer (7) comprises aluminium particles.

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International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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G02B 5/128		A1
(43) International Publication Date: 10 September 1999 (10.09.99)		
(21) International Application Number: PCT/SE99/00254		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SL, SK, SL, TI, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TI, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
(22) International Filing Date: 24 February 1999 (24.02.99)		
(30) Priority Data: 9800689-3 5 March 1998 (05.03.98) SE		
(71) Applicant (for all designated States except US): DECORE- SPONZ I HELSINGBORG AB [SE/SE]; P.O. Box 132, S-263 22 Höganäs (SE).		Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Swedish).
(72) Inventor: and (73) Inventor/Applicant (for US only): ANDERSSON, Stig [SE/SE]; Lerbergsvägen 72, S-263 32 Höganäs (SE).		
(74) Agent: STRÖM, Tore et al.; Ström & Gulliksson AB, P.O. Box 4188, S-203 13 Malmö (SE).		
(54) Title: REFLECTING MATERIAL		
(57) Abstract		
<p>A material for thermoforming comprises a plastic layer as well as a layer of reflecting pearls in an adhering transparent substance. The material is suitable for the manufacturing of a reflecting product by means of vacuum forming.</p>		

**REFLECTING MATERIAL***Field of the Invention*

The present invention refers to a material for thermoforming as well as to the use of this material for the manufacturing of a reflecting product by means of thermoforming.

*Background of the Invention*

While performing different activities during more or less bad lighting, it is important for a person performing the activities to be completely visible. At present, a person can obtain a lower degree of protection by different types of reflex tapes, so as to be visible during poor light conditions. This does not only apply to different types of spare time activities, such as bicycling and horse riding, but also to activities related to employment, such as for instance firemen and policemen, which have to protect themselves with adequate reflector means when working professionally under conditions with low levels of lighting. In this connection a "reflector means" accomplishes a reflection in which light is reflected in directions close to the direction from which it came.

In the nowadays existing traffic environment, it is especially important to protect the head, and this applies to children as well as grown-ups. However, conventional helmets are not easily noticed, for example, by motorists at night, and the user may risk injury from a traffic accident on such occasions even if a helmet is used. In order to alert a motorist under these conditions, several types of reflecting warning signs, which are visible at night, are now commercially available.

Ordinary plane reflector means, however, have a limited protecting effect by only emitting light when struck by light from only one direction. It is true that different kinds of adhesive reflecting tapes exist which can be fastened for example on clothes or helmets. However, a self-adhesive material, such as a 'sticker', cannot be

applied to a curved surface due to the formation of wrinkles. On the same grounds, it can neither be applied to a material in the form of a sheet which subsequently is fixed onto a curved surface by means of thermoforming.

- 5 since the material then will crack or crackle. Due to the above mentioned problems, reflecting materials according to the state of the art rapidly lose their reflecting properties when applied to irregular or curved surfaces.

The purpose of the invention is thus to provide a  
10 reflecting material which can be used both as a reflecting plane sheet per se and as a material for thermoforming, preferably by means of vacuum forming, to a curved or irregular surface, the material retaining its reflecting property without crack formation or cracking. [In order to  
15 achieve this purpose, the invention has obtained the characterizing features of claim 1 and its use has obtained the characterizing features of claim 16.]

[In order to explain the invention in more detail,  
reference is made to the accompanying drawing, in which]  
20 *Brief Description of the Drawing*  
FIG 1 schematically shows a cross section through a reflecting material in the form of a sheet according to the invention,

FIG 2 schematically shows a cross section through a further development of the embodiment of the material  
25 according to the invention, which is shown in FIG 1;

FIG 3 schematically shows a cross section through an alternative embodiment of the material according to the invention, and

FIG 4 schematically shows a cross section through a material according to a preferred embodiment of the invention.

*Detailed Description of the Drawings*  
In FIG 1 the material according to the invention is shown in its most simple form, and consists of a plane sheet 1 which is coated with a reflecting layer 2. The sheet 1 can be of every type of plastic material. However,

it is preferred that the sheet comprises a transparent thermoplastic polymer material, preferably crystal-clear polyvinyl chloride (PVC) or polyester, the polyester being preferred since it is more harmless to the environment.

5 The reflecting layer 2 comprises a suspension of pearls, for example of glass or plastic, in an adhering substance, preferably a lacquer. In this connection a lacquer means a non-pigmented liquid with an organic film forming substance which can be a natural resin, a synthetic 10 resin or an oil. Preferably a so-called screen printing lacquer is used.

It is an important aspect of the invention that pearls of a certain size are mixed with the adhesive substance. Preferably, the pearls have a diameter between 15 0.01 and 0.05 mm. The adhesive substance must be able to attach to the plastic at the same time as it shall be able to bind to the pearls. Thus, the adhering substance comprises an etching transparent glue coating. In this connection etching refers to an increase in surface 20 roughness of the plastic by dissolution of the same. After the application of the reflecting layer 2, the adhering substance in the form of a lacquer is hardened, preferably by means of heat, but it can also be hardened in other ways, for example by means of radiation.

25 In order to obtain a reflecting laminated material according to the invention, the adhering substance and pearls of for example glass or plastic are mixed into a suspension which must have a suitable consistency so that the pearls of microscopic size will be transferred to the 30 plane sheet 1 by means of a known technique in the form of screen printing (silk screen processing). This is a method which normally is used for applying a pattern to a plastic sheet which is to be subjected to thermoforming. The size of the pearls is thus also adapted to be able to pass 35 through the open holes of a screen stencil which normally

is used for pressing a pattern medium against the sheet. When the pearls used are of glass, they must be polished pearls of high quality. The same type of glass pearls as in existing reflecting tapes can be used with advantage.

- 5 Preferably, the size of the glass pearls lies within the range of 0.01-0.05 mm.

By this procedure, the suspension is anchored on the plane material, a reflecting surface being obtained. The more pearls mixed into the suspension, the better 10 reflectance is achieved. In this connection the amount of glass pearls suspended in the adhering substance in the form of a lacquer could surprisingly comprise as much as 85 %. This results in the consumption of 1 kg glass pearls for covering 4-5 m<sup>2</sup> of the sheet, which after thermoforming 15 for example can be used for shells for about 50 helmets of normal size.

The material according to the invention can in this embodiment also be used for achieving a reflection in two directions, by the reflective layer being applied to both 20 sides of a suitable surface. It is of advantage if this surface is a sheet of plastic material which can be thermoformed. Preferably all kinds of existing materials of polyvinyl chloride (PVC) are used, i.e. all thermoplastic materials which comprise polymers of vinyl chloride. The 25 plane reflecting material can also be used without thermoforming in the form of a traffic sign or another warning sign indicating danger or other circumstances which should be observed by the public.

When the reflective layer 2 has been applied to the 30 sheet 1, other patterns can be printed on the material according to the invention. This is then thermoformed, for example by means of vacuum forming, to a shape corresponding to the curved surfaces, which the shells thus formed are intended to fit. The thermoplastic material 35 according to the invention, in the form of a plane or

flexible sheet or foil of a thickness which is sufficient for vacuum forming, is then heated to its vacuum forming temperature and formed to a general contour of a mould by means of a pressure difference. Thus, vacuum forming is 5 performed by means of known techniques at 130 °C, the material being drawn and stretched to a shell which for example has the shape of a helmet.

After cooling, the thin shells formed are ~~sawn~~ into 10 separate units, and holes are optionally punched out in them. If the shells are to be used in a finished product in the form of a helmet, the shell is finally glued onto an inner helmet which has a protective effect on the head.

The helmet can then, if desired, be built in with a further plastic layer. This can be necessary since the 15 virtual reflection can be reduced, i.e. in humid weather. For this reason a further coating is applied to the finished product, e.g. a layer which protects the reflecting layer and strengthens it even more. As shown in FIG 2, this can be achieved by a further layer 3 of 20 preferably PVC being applied by means of for example high-frequency welding to the reflecting layer 2 which in turn is disposed on the plane sheet 1.

A more cost-efficient embodiment of the invention according to FIG 1 is shown in FIG 3; a plane sheet 1 of 25 preferably a plastic material being used as above, said material being workable by means of vacuum forming. In this embodiment a layer 4a of an adhering substance is disposed on the sheet 1, and a thin layer 5 of pearls is applied to the layer 4a. A further layer 4b of an adhering substance 30 is again disposed over this layer 5 of pearls.

The layers 4a and 4b preferably consist of the same transparent glass-clear adhering substance in the form of a lacquer, the lacquer in the layer 4a being etching as in the previous embodiment.

With reference to FIG 3, the reflecting laminated material is achieved by the etching layer 4a of adhering substance being applied to the sheet 1. Pearls are spread onto this layer before it has dried. This can for example  
5 be accomplished mechanically with an equipment which usually is utilised for coating with different kinds of powders. Glass pearls are for example spread in this procedure so that they will fall down onto the still sticky layer 4a, a monolayer of glass pearls contacting the same  
10 with non-adhering pearls on the top. The sheet with accompanying layers 4a and 5 is then allowed to pass an oven for curing of the adhering substance in the layer 4a. When this layer has been cured, non-adhering glass pearls can be sucked off and reused. Another layer 4b of adhering substance is then applied to the layer 5 of glass pearls,  
15 the sheet with accompanying layers then being allowed to pass the oven again for curing of the layer 4b.

The material according to this embodiment of the invention can also be vacuum formed into a reflecting shell  
20 to be applied to a curved surface without any crackle formation taken place during the forming procedure. The reflecting surface is sufficiently well adapted for many applications in order to provide for an efficient reflecting effect.

25 In FIG 4 an embodiment is shown which is especially preferred when the material according to the invention is to be used for reflecting helmets. By arranging the product in the form of a shell from the material according to the invention for example on the inside of a bicycle helmet, in  
30 which holes have been cut out for the reflecting material, the reflecting product can be used where it is more protected from the surrounding world. In this embodiment this can be achieved by a layer of the material according to the invention being arranged on that side of the sheet 1  
35 which in the finished helmet will not be directed towards

the light source, i.e. the sheet 1 acts as a protecting layer for the other layers.

With reference to FIG 4, a colour layer 6 is arranged between the sheet 1 and the layer 4a of an adhering substance. The colour layer 6 comprises a transparent dye known in the art, which can be excluded in dependence of the design and appearance of the final product. The reflecting layer is arranged as in the preceding embodiment in the form of a single layer of pearls, for example of glass or plastic, between two layers, 4a and 4b, of adhering substance. In this connection the adhering substance used should be able to etch dyes as well as plastics.

A layer 7 of a material with high gloss, for example silver or aluminium, is disposed on the layer 4b of adhering substance in order to further amplify the reflection. Preferably, aluminium particles are used. Thus, when the reflecting layer 5 is illuminated, the light not immediately reflected by this layer will be reflected with total reflectance by the layer 7 and re-transmitted towards the observer after reflection by the pearls in the layer 5.

The layer 7 is preferably applied to the laminate according to the invention as a paste of commercial aluminium particles by means of the above-mentioned technique in the form of screen printing.

The reflecting laminated material according to the invention can then be heated to a temperature which is suitable for vacuum forming, e.g. 130 °C, vacuum forming then being performed as described above. The reflecting material in the form of a sheet according to the invention must in this connection have a thickness which is sufficient considering the product contemplated after vacuum forming. The material can for example be vacuum formed into a shell in the form of a helmet which becomes highly reflecting from the outside with the reflecting

layer on the inside of the helmet, the reflecting layer thus being protected against all types of damages. In this way a helmet of impact-resistant plastic can be achieved with reflecting patterns as well as usual patterns, which  
5 can result in increased road safety, especially for children.

- It should be observed, that a colour layer, if desired, can be arranged in a corresponding way in other embodiments of the invention. In this connection the  
10 location of the colour layer in the laminate is not crucial. A dye can also be mixed into the suspension of pearls and adhering substance, a reflection of the corresponding colour then being obtained. In this connection the dyes should also be transparent.  
15 Furthermore, it is important that all transparent components in the material according to the invention retain this property after thermoforming, such as vacuum forming.

Warning articles manufactured from the material of  
20 the present invention present a reflective construction which is durable, rather cheap and quite visible under poor natural light conditions, especially at night, when the reflecting articles are illuminated by an external active light source, such as a light from a head light of a car.  
25 By the vacuum forming property of the inventive material, the invention can be used for increased safety, especially on the roads. Products having an irregular or curved surface can be produced with a functional reflectance when the present invention is used. Thus, all kinds of light  
30 reflecting products can be achieved, such as bicycle helmets, protective helmets for building workers and playing children, and so on. Accordingly, the invention can be used as a reflective device with the capability of reflecting light and thus being visible from all angles,  
35 i.e., a retro-reflecting device generating a reflection in

all directions and usable on a person as such. Other products for increased road safety can also be obtained by using the invention when a more or less completely reflecting surface is desired, such as hub caps with 5 ornaments and reflective patterns.

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## INTERNATIONAL SEARCH REPORT

1

International application No.

PCT/SE 99/00254

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC6: G02B 5/128**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC6: G02B**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## EPDOC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2356166 A2 (BOULARD REMY MARIE PAUL), 20 January 1978 (20.01.78), claim 7 --	1-9,11
A	FR 2716008 A1 (YOU CHING CHYR ET AL), 11 August 1995 (11.08.95), figures 2,6, claim 1 --	1-4
A	WO 9710279 A1 (MINNESOTA MINING AND MANUFACTURING COMPANY), 20 March 1997 (20.03.97), figures 1,2, claims 1,13 -- -----	1-4,6-9,13, 14

 Further documents are listed in the continuation of Box C. See patent family annex.

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

03/05/99

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